NEVADA DEPARTMENT OF WILDLIFE
NATIVE FISH AND AMPHIBIANS
FIELD TRIP REPORT

DATE(S): 17, 18, 24, and 25 October, 2006
LOCATION(S): Ash Meadows National Wildlife Refuge
PURPOSE(S): To estimate the population sizes of Ash Meadows Amargosa pupfish and Ash Meadows speckled dace and also to monitor exotic species removal efforts.
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PREPARED BY: Joel Wixson

INTRODUCTION

Fish population monitoring has been ongoing since the 1980s at Ash Meadows National Wildlife Refuge. This year we conducted surveys on the Ash Meadows Amargosa pupfish, *Cyprinodon nevadensis mionectes*, and the Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*, both of which are federally listed as endangered. Longstreet, Fairbanks, School, Rogers and North Indian springs were surveyed this year.

METHODS

On 17 and 18 October 2006, standard mesh (0.64 centimeter [cm]) Gee-type minnow traps (2.5 cm openings), and Gee-type "exotic fish" minnow traps with 0.32 cm mesh (2.54 cm openings), were baited with 10-15 pieces of Chef's Blend dry cat food and were distributed evenly throughout each springhead and outflow, if applicable. They were allowed to fish for about 3 hours. Fifty or more native fish were measured from exotic fish traps at each spring. Exotic fishes were rehabilitated on shore. Since few pupfish were captured on 18 October in both Fairbanks and North Indian springs, a second marking event occurred on 24 October. In Fairbanks Spring, native fish measuring 26 millimeters (mm) or greater were marked on 24 October. We decided on 26 mm because almost all fish that we tested that were less than 25 mm in length could swim through the holes in the standard mesh traps. In all other springs, all native fish greater than or equal to 30 mm were marked with an oblique clip on the caudal fin and released. All exotic fish were counted and reintroduced to a drier environment.

On 24 and 25 October, School, Rogers, Longstreet and North Indian springs were trapped using standard traps. The traps were pulled about 3 hours later. Fairbanks Spring was trapped for the third time on 27 October. Native fish were examined for marks, tallied, and released. Exotic fish were tallied and rehabilitated on shore.

Estimates were calculated using the simple Petersen equation, M*C/R (where M=number of fish marked, C=number inspected for marks, and R=number of recaptured fish). Schnabel's method was used for Fairbanks and North Indian springs since both springs were trapped three times. Approximate 95% confidence intervals were obtained

by the method recommended in Ricker (1975), using a table based upon the Poisson distribution.

RESULTS

School Spring

On 18 October, 2 standard traps and 1 exotic trap were set in each of the three pools at the School Spring Warm Springs pupfish Refuge. All traps were allowed to fish for 3.5-4 hours for a total trapping time of 31.5 hours. One hundred and one pupfish were captured, of which, 55 were given a mark. Forty-two red swamp crayfish (*Procambarus clarkii*) and 97 mosquitofish (*Gambusia affinis*) were also caught. Ninety-one mosquitofish were also removed by dip-net. Figure 2 shows the length frequency histogram for pupfish measured in School Spring.

On 24 October, 2 standard traps and 1 exotic trap were set in each of the three pools. They fished for 3 hours for a total trapping time of 27 hours. Twenty-six crayfish and 13 mosquitofish were caught. Ninety pupfish were captured of which 47 were marked. The population estimate for *C. n. mionectes* at School Spring was 105 (73-159, p=0.95) (Figure 1). The catch per unit effort (CPUE) for all species is displayed in Table 1.

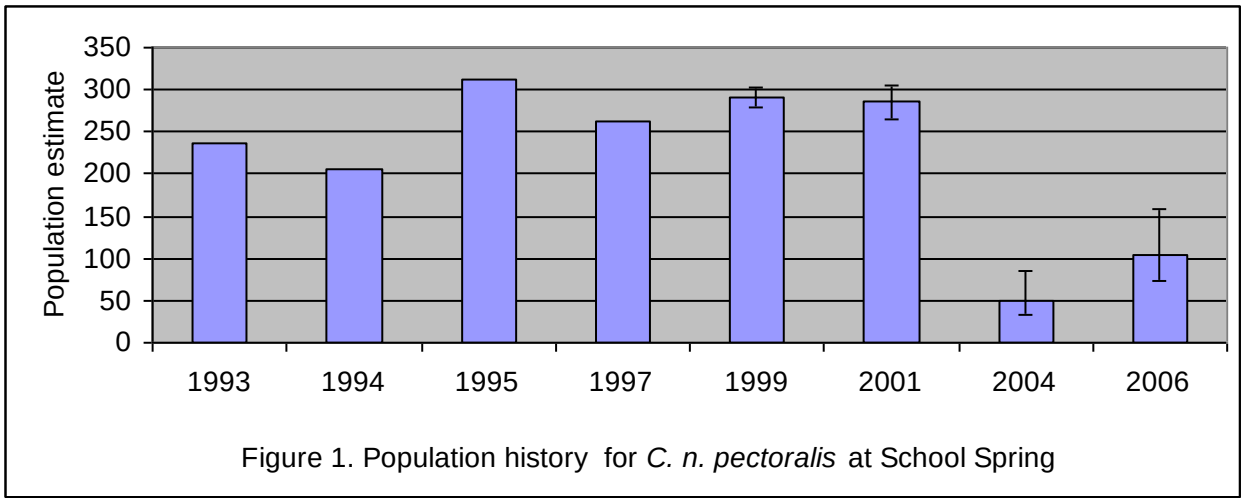
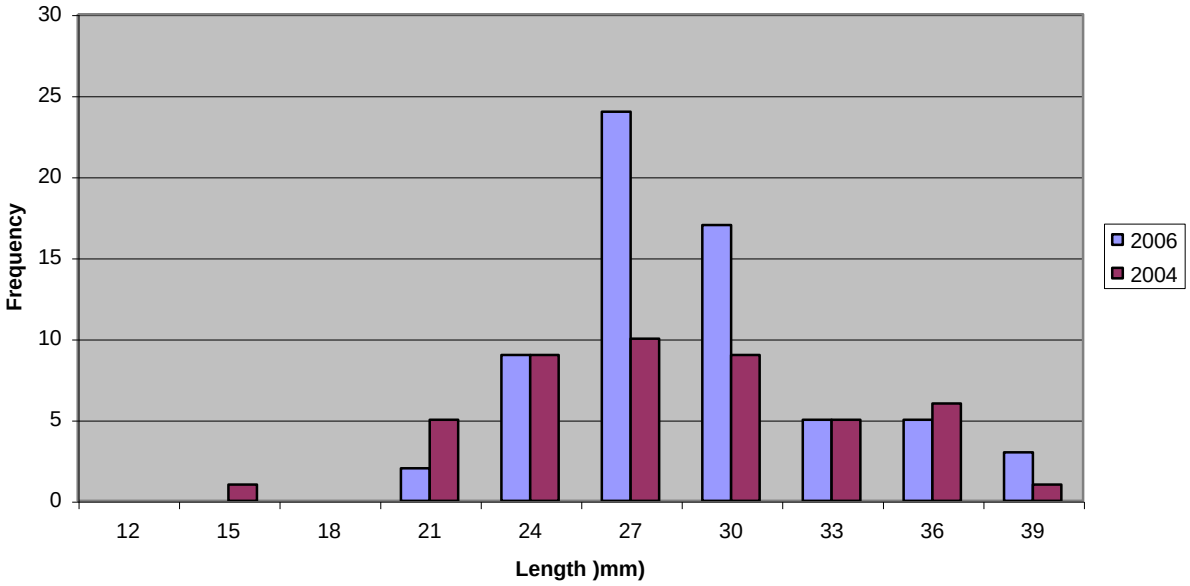


Figure 1. Population history for *C. n. pectoralis* at School Spring

Figure 3. Length frequency for *C. n. pectoralis* from School Spring



North Indian Spring

On 18 October, 1 exotic trap, and 2 standard traps were placed into North Indian Spring. Of the 3 traps placed in North Indian Spring, 2 traps (1 standard and 1 exotic) were placed in the stream section of the spring, and the remaining 1 trap was placed in the large spring pool below the uppermost spring source. All traps were allowed to fish for 3 hours which resulted in a total trap time of 9 hours. Eight Warm Springs pupfish (*C. n. pectoralis*) were caught and marked. Fish over 30 mm were marked and returned to the spring. One mosquitofish was also caught and removed.

On 24 October, 3 traps were placed into North Indian Spring (2 standard and 1 exotic). All 3 traps were placed in the large spring pool and allowed to fish for 3 hours with a total fishing time of 9 hours. Ten pupfish were caught; of which 0 had a caudal fin mark.

Of the 10 fish caught, 8 were marked with a caudal fin clip and returned to the spring pool. One crayfish was also caught. Due to the low number of fish in both captures, surveyors decided to set the traps again on October 25, in order to get a more accurate population estimate of Warm Springs pupfish in North Indian Spring. On October 25, 5 traps were used (4 standard and 1 exotic), all traps were allowed to fish for 3 hours with a total fishing time of 15 hours. Twenty-two Warm Springs pupfish were caught, of which 10 were marked. Using the modified Schnabel's estimator, the Warm Spring pupfish population estimate at North Indian Spring was 39 (22-76, p=0.95) (Figure 5). During the first two sampling events all pupfish were measured regardless of trap mesh size and a length frequency histogram is shown in Figure 6.

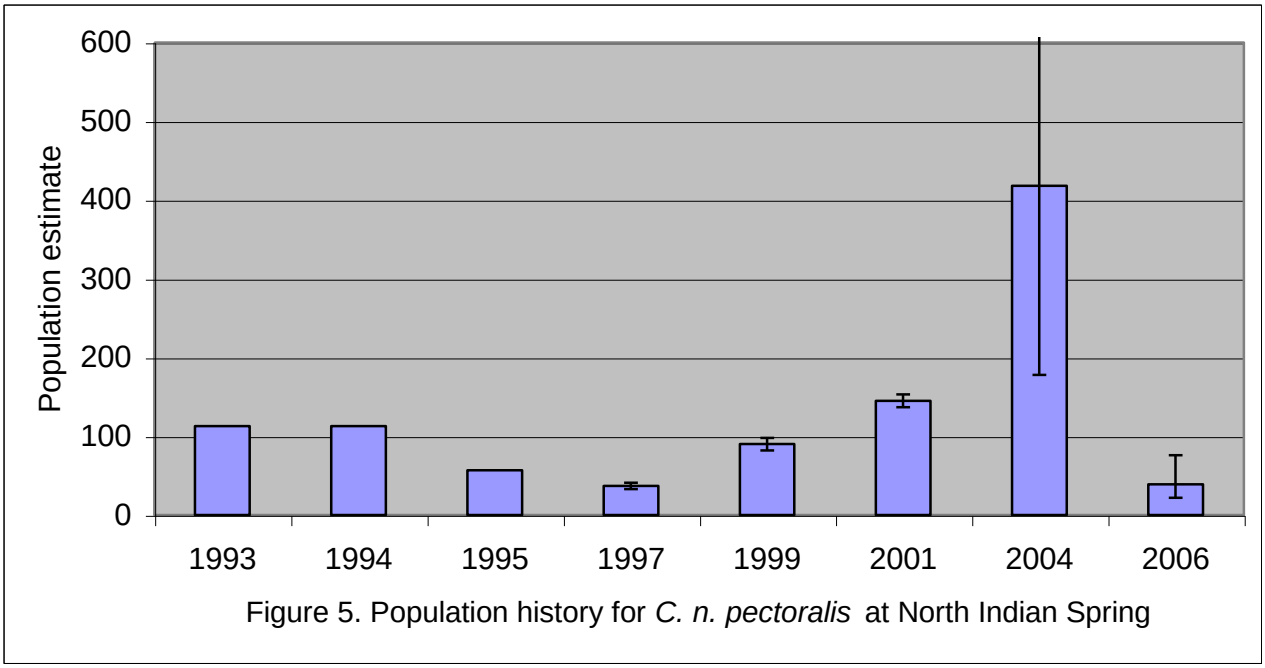
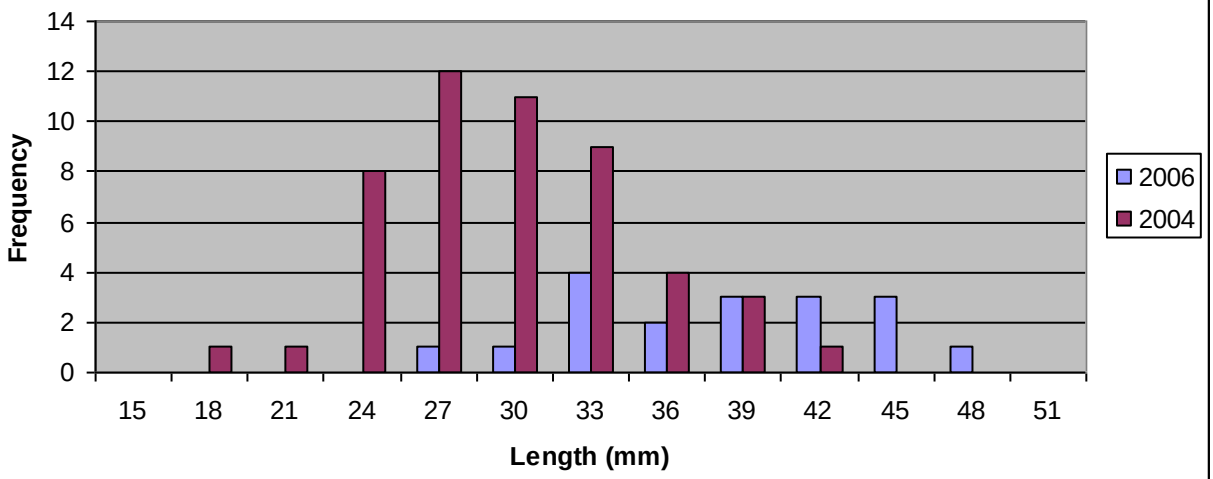


Figure 5. Population history for *C. n. pectoralis* at North Indian Spring

Figure 4. Length frequency for *C. n. pectoralis* from North Indian Spring



Longstreet Spring

On 17 October, 4 exotic traps and 10 standard traps were placed in the springhead and allowed to fish for 3 hours for a total trapping time of 42 hours. Three hundred and seventy five Ash Meadows pupfish were captured, of which 156 were marked. Thirteen crayfish, 268 mollies, and 15 Mosquitofish were also caught. The length frequency histogram for the pupfish measured at Longstreet Spring is shown in Figure 4.

On 25 October, 10 standard traps were set in the springhead and allowed to fish for 3 hours for a total trapping time of 30 hours. Two hundred and fifteen Ash Meadows pupfish were caught, of which 72 had marks. Seven crayfish, 9 mosquitofish, and 94 mollies were also caught, tallied and removed from the system. The population estimate for *C. n. mionectes* at Longstreet Spring was 466 (370-587, p=0.95) (Figure 3). The CPUE for all species is displayed in Table 1.

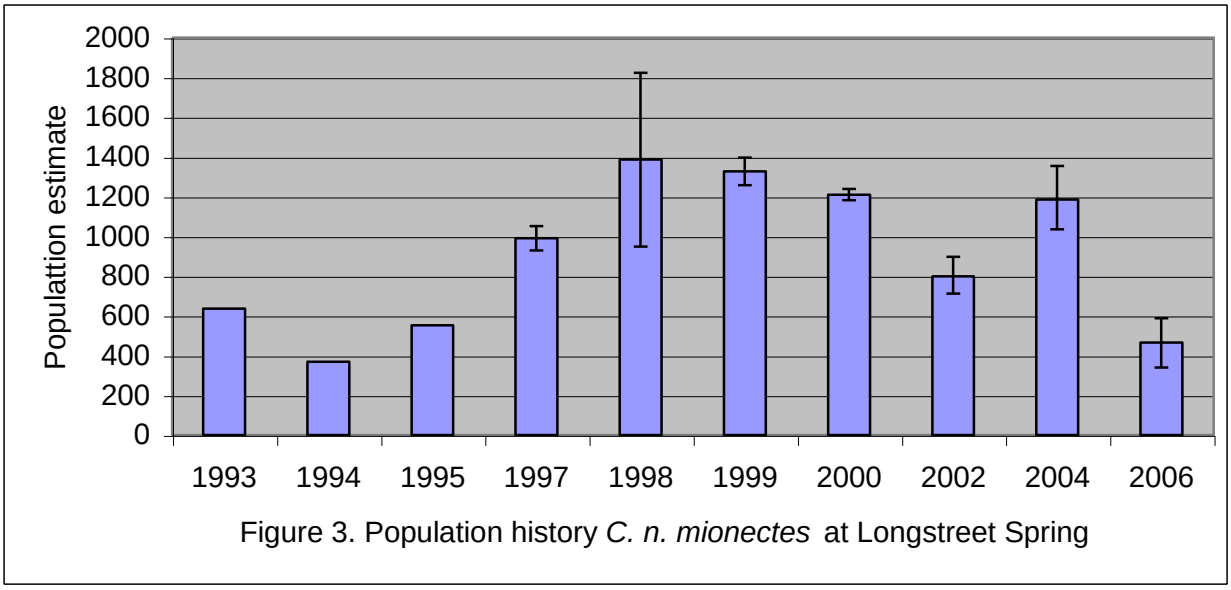
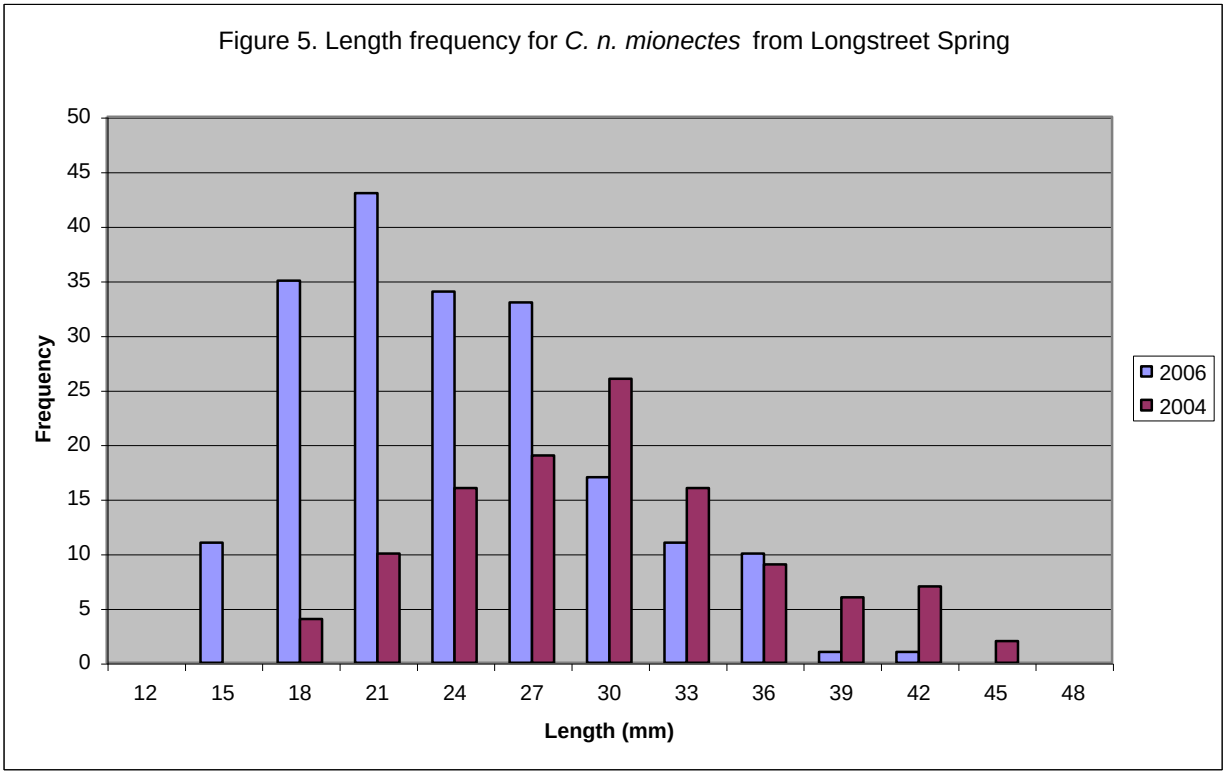


Figure 3. Population history *C. n. mionectes* at Longstreet Spring



Rogers Spring

On 17 October, 2 exotic traps and 4 standard traps were placed in the springhead and allowed to fish for 4 hours for a total fishing time of 24 hours. Four hundred and twenty-nine Ash Meadows pupfish were caught of which 155 were marked. See Figure 8 for the length frequency histogram. Thirty-one crayfish and 137 mosquitofish were also captured and removed.

On 25 October, 4 traps were set in the springhead and allowed to fish for 3.5 hours, for a total time of 14 hours. One hundred and seventy four pupfish were caught of which 49 were recaptures. The population estimate for *C. n. mionectes* was 550 (385-822, p=0.95) (Figure 7).

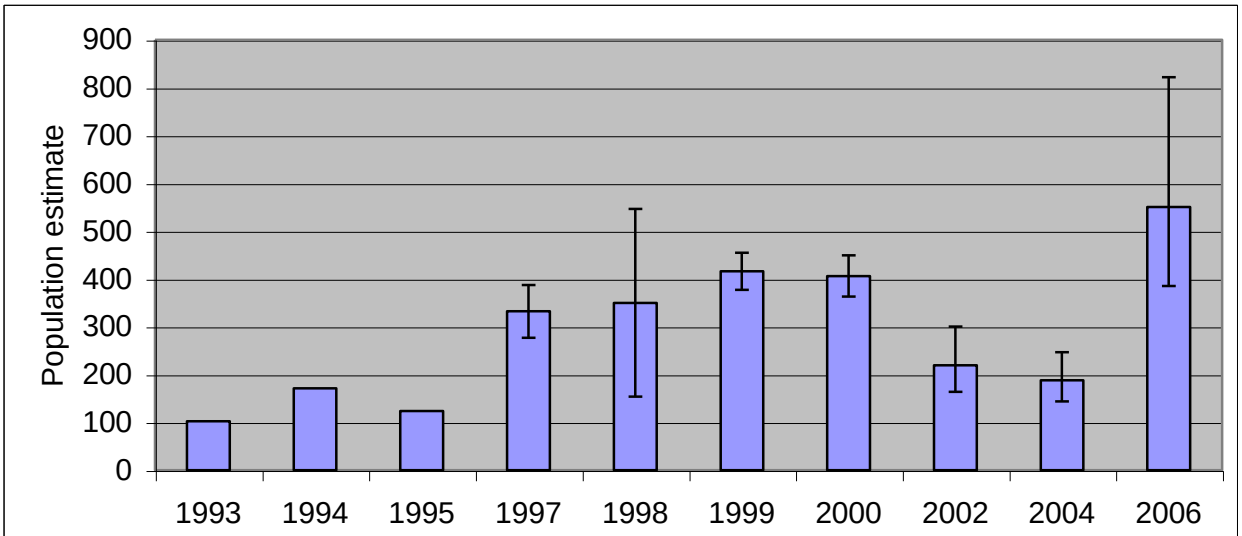
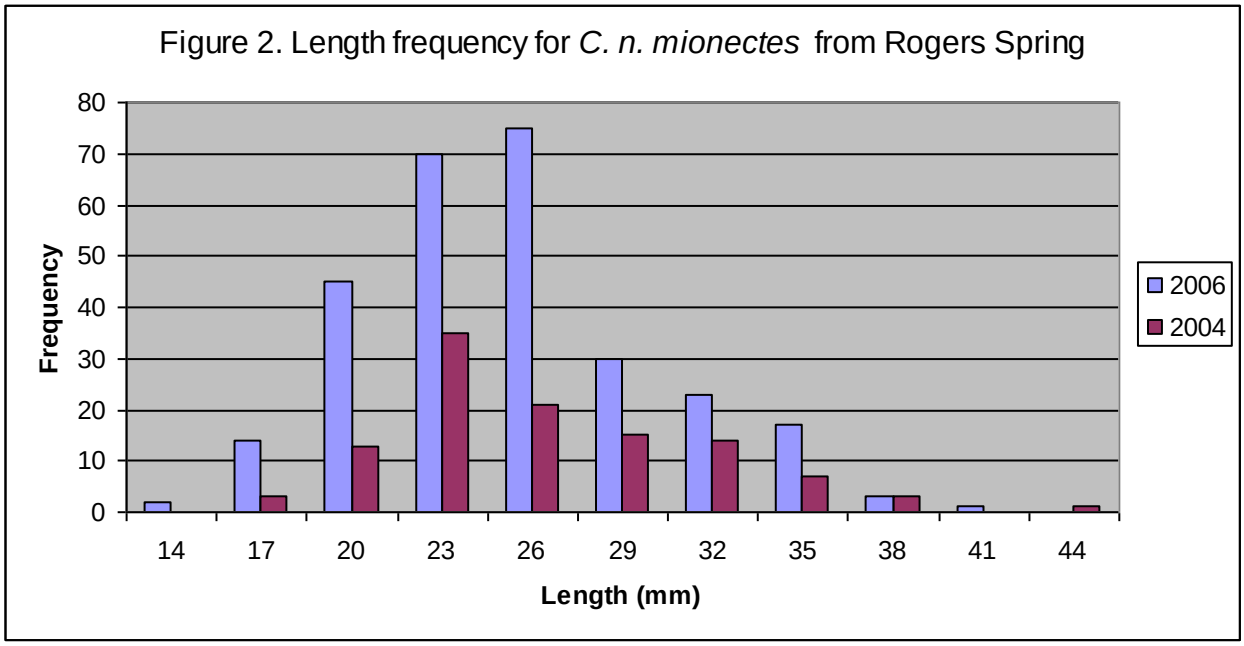


Figure 7. Population history for *C. n. mionectes* at Rogers Spring



Fairbanks Spring

On 18 October, 10 standard traps, and 4 exotic traps were set in Fairbanks Spring, and allowed to fish for 3 hours for a total fishing time of 42 hours. Twelve Ash Meadows pupfish were caught; 10 of which were given a mark. Four mosquitofish, 13 cichlids, and 1 bullfrog tadpole were also caught. Since very few pupfish were captured during this first trapping occasion, a decision was made to have two more marking events.

On 24 October, 7 standard traps and 2 exotic traps were set in the springhead and allowed to fish for 3 hours for a total fishing time of 27 hours. Four hundred and twenty four Ash Meadows pupfish were caught of which 6 had a mark from the previous capture. One hundred and ninety-five were given a caudal fin mark and returned to the springhead. One hundred and seven cichlids, 2 bullfrog tadpoles, 2 crayfish, and 2 mosquitofish were also captured. The length frequency histogram for all fish measured at Fairbanks Spring is shown in Figure 10.

On 27 October, 10 standard traps were placed in the springhead, and allowed to fish for 3 hours for a total fishing time of 30 hours. One hundred and fifty seven ash meadows pupfish were caught, of which 73 had marks. Eighteen cichlids, 8 crayfish, and 2 bullfrog tadpoles were also caught. Using the modified Schnabel estimator for multiple marking events, the population estimate for the Ash meadows pupfish at Fairbanks Spring is 608 (494-768, p=0.95) (Figure 9).

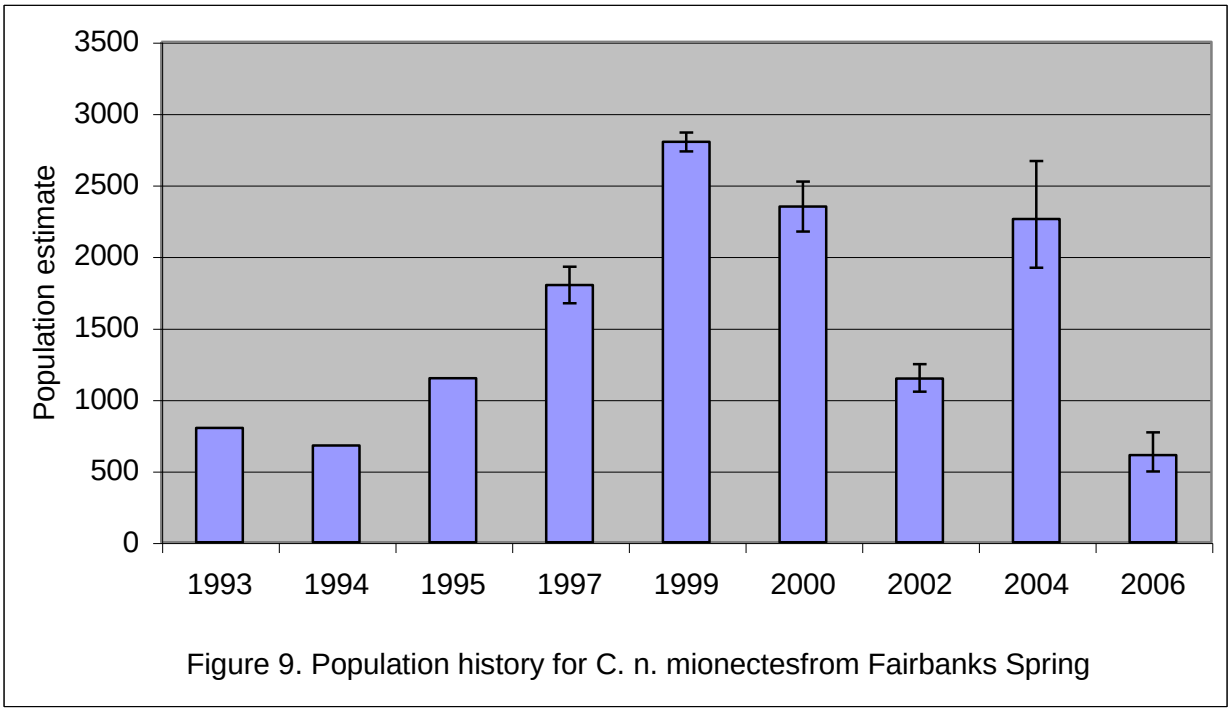
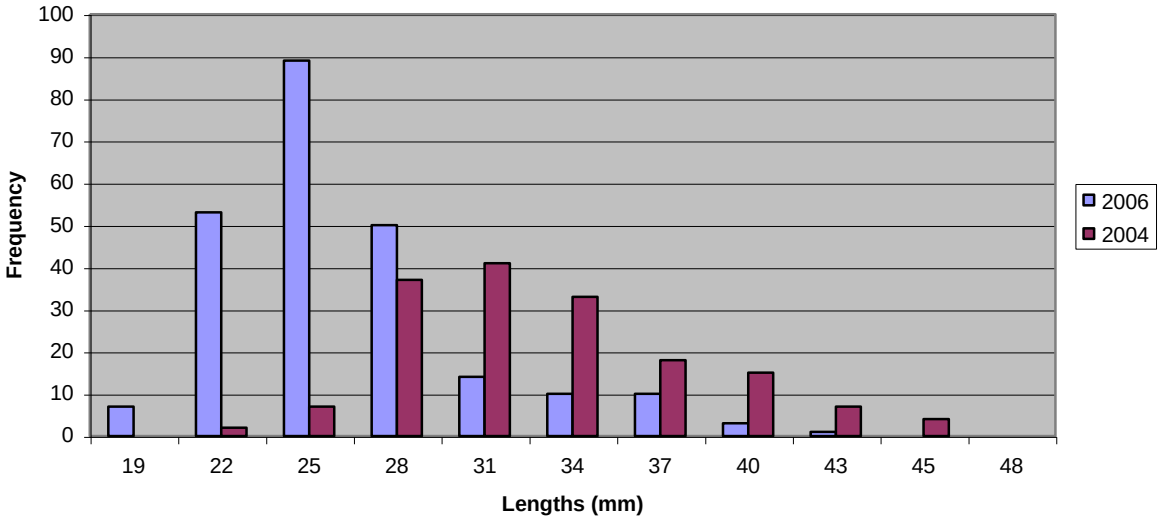


Figure 9. Population history for C. n. mionectesfrom Fairbanks Spring

Figure 1. Length frequency for *C. n. mionectes* from Fairbanks Spring



Point of Rocks

On 28 October, 10 standard traps were placed in the pool and allowed to fish for 3 hrs, for a total trapping time of 30 hours. Ninety-six Ash Meadows pupfish were captured and all 96 were marked with a caudal fin clip. No speckled dace were captured. Forty-four crayfish, 90 mollies, 1 *Gambusia* and 1 tadpole were also caught.

On 3 November, 2 exotic traps, and 10 standard traps were set in the pool. They fished for 3-4 hours for a total trapping time of 36.69 hours. Thirty-six crayfish, 9 *Gambusia*, 14 mollies, and 3 bullfrog tadpoles were captured. One hundred and seventy one pupfish were examined of which 69 were marked. The population estimate for *C. n. mionectes* at Point of Rocks was 237 (190-301, p=0.95) (Figure 11). The population estimate for *R. o. nevadensis* at Point of Rocks was not determined.

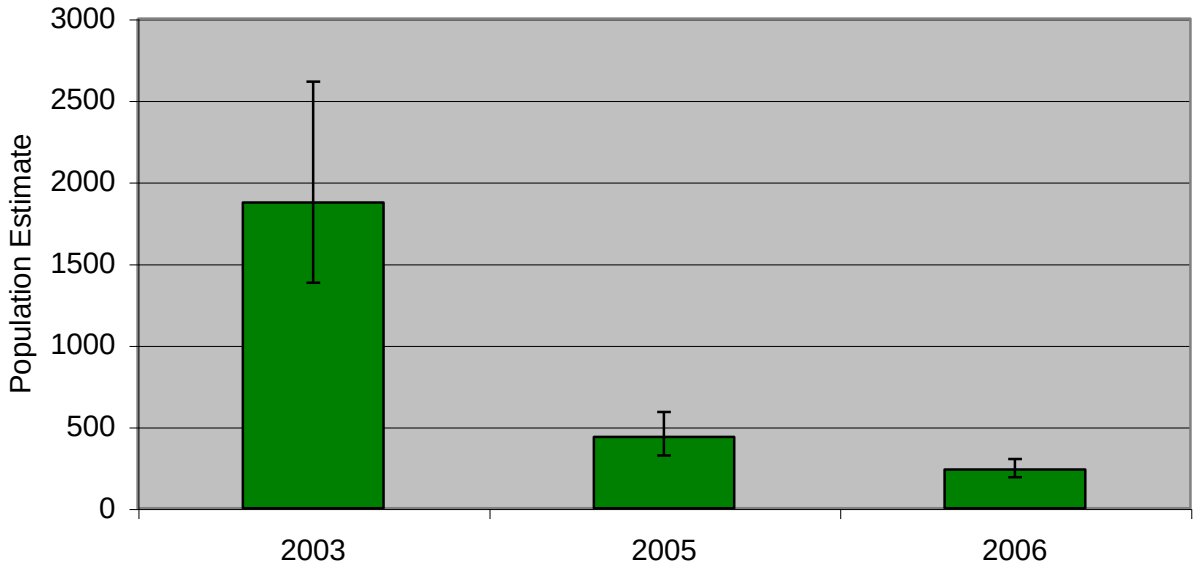


Figure 11. Population Estimates for *C. n. mionectes* at Point of Rocks, 2003-2006.

Figure 7. Length-frequency for native fishes at Point of Rocks.

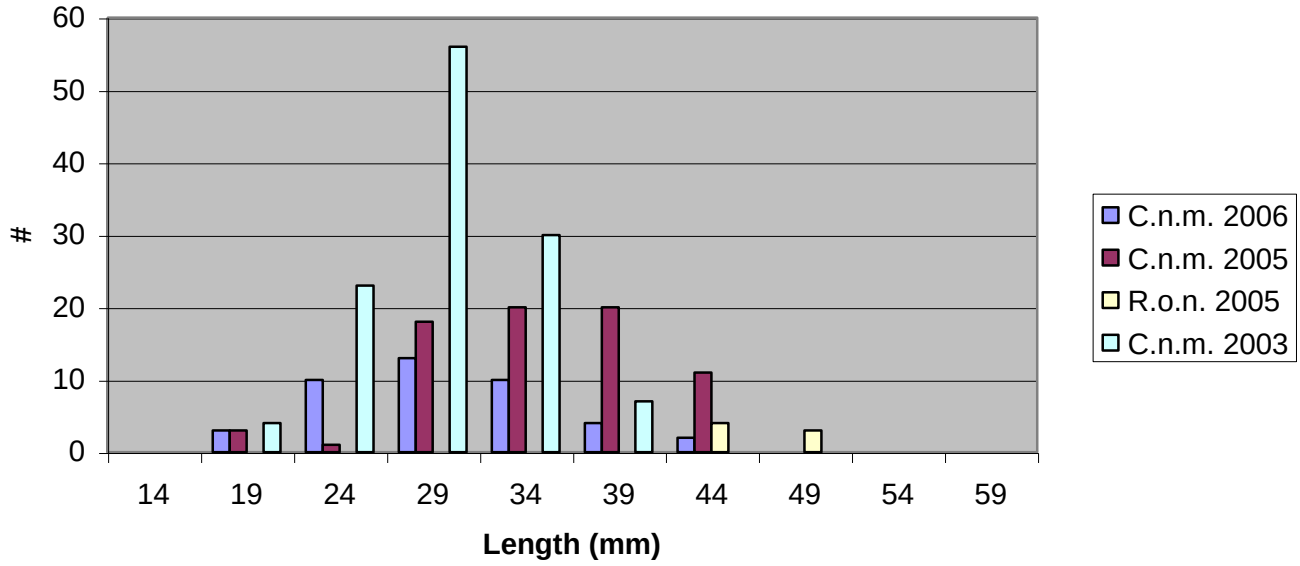


Table 1. Catch per unit effort at Ash Meadows, Nye Co., NV, 2006.

Location	Date	Warm Springs Pupfish	Ash meadow's pupfish	Crayfish	Mollies	*Gambusia*	Cichlids	Tadpoles
Longstreet Spring	10/17/06	0	8.69	0.31	6.38	0.36	0	0
	10/25/06	0	7.17	0.23	3.13	0.3	0	0
School Spring	10/18/06	3.74	0	1.56	0	6.96	0	0
	10/24/06	3.33	0	0.96	0	0.48	0	0
Fairbanks Spring	10/18/06	0	0.29	0	0	0.95	0.31	0.24
	10/24/06	0	15.70	0.07	0	0.07	3.96	0.07
	10/27/06	0	5.23	0.27	0	0	0.60	0.07
Rogers Spring	10/17/06	0	17.88	1.29	0	5.70	0	0
	10/25/06	0	14.64	0	0	0	0	0
North Indian Spring	10/18/06	0.89	0	0	0	0.11	0	0
	10/24/06	1.11	0	0.11	0	0	0	0
	10/25/06	1.47	0	0	0	0.07	0	0
Point of Rocks	10/28/06	0	3.20	?	?	0.03	0	0.03
	11/3/06	0	4.66	0.98	0.38	0.25	0	0.08

DISCUSSION

School Spring

The pupfish population at School Spring Warm Springs pupfish refuge increased to 105 individuals which is over twice the 2004 estimate of 50. While this appears to be good news, estimates from 1993 to 2001 averaged 266 individuals. This decrease may very well be caused by mosquitofish which were first documented at School Spring in 2001. It is unlikely that mosquitofish were present as early as 2000 since the population estimate was still similar to previous years. The decline in the population may also have been due to a lack of crayfish trapping after 2001, which coincided with a change in refuge and NDOW staff. Continued trapping and removal of exotic species at this site should be resumed on as consistent a basis as possible to hold numbers at bay until planned restoration efforts can relieve the problem altogether.

North Indian Spring

The Warm Springs pupfish population estimate at North Indian Spring went from 418, with a large confidence interval (178-1306, p=0.95), to the second lowest count since 1993 of 39. The population at this site continues to persist at low numbers and due to the constraints of the habitat is very difficult to trap. Restoration and eradication of nonnatives is crucial to the continued existence of pupfish at this site and the other Warm Springs sites.

Longstreet Spring

The Ash Meadows Amargosa pupfish population in Longstreet Spring continues to decrease. Except for an increase in 2004, the population has been decreasing since 1998 and 1999. While there is little cause for great concern, the number of nonnatives in Longstreet is substantial and this spring should be part of a regular series of trapping sessions at all of the springs on the refuge to try to keep the exotic species at bay.

Rogers Spring

This year's estimate of 550 Ash Meadows Amargosa pupfish is the highest ever in Rogers Spring. No special activities have taken place at Rogers Spring in the last couple years, so the increase in the population size cannot be readily explained other than environmental conditions were favorable. Exotic species maintenance should also be done at this site.

Fairbanks Spring

We witnessed what may have been the aftermath of an intense bout of predation at Fairbanks Spring. Only twelve Ash Meadows Amargosa pupfish were captured in 42 hours of trapping on the first day of the mark-recapture survey and very few fish were seen in the spring. When the spring was trapped 6 days later, we captured 424 pupfish, which is a normal number of fish trapped at this spring during fall surveys. It is suspected that piscivorous birds were the culprits. Because so few pupfish were captured and marked the first day, fish from the second day of sampling were also marked and a third and final day of trapping was completed 3 days later. The estimate of 684 pupfish was the lowest of all of the surveys conducted since 1993. It is likely that the event that occurred before our arrival took its toll on the population. Site visits are recommended at this site over the next year to be sure that the population is not lost to a habitual predator. It is also recommended that this spring be trapped on a more regular basis to remove exotic species and attempt to keep their numbers as low as possible.

Point of Rocks

The Ash Meadows Amargosa pupfish population estimates at Point of Rocks have been decreasing since 2003. This year's estimate did not include the outflow (as in past surveys) which may be why the estimate was lower. This site underwent renovation in 2002, and 2003 was the first year that surveys were possible. The 2003 count could have been a population expansion in response to the increase in open, useable habitat. The count from this year and 2004 would then be the population returning to sustainable levels. Nonnative aquatic species cannot be ruled out either and trapping at this site to remove these species should be carried out on a regularly scheduled basis. Future surveys should include the outflow as far downstream as possible to include as much pupfish habitat as possible. This would also allow us to capture more of the recently reintroduced Ash Meadows speckled dace, which use habitat further downstream from the spring source where temperatures are too high.

Refuge-wide

The resumption of consistent and intensive trapping and removal of nonnative aquatic species at the Ash Meadows National Wildlife Refuge is needed to maintain the lowest number of these species possible. While it is recognized that many of these species cannot be eradicated by physical removal, reducing their numbers can be very important to the continued survival of native fish species by allowing them to reach the greatest population size possible. NDOW, FWS-ES and refuge staff will determine what the intervals and methods for each spring will be.

LITERATURE CITED

Ricker WE. 1975. *Computation and Interpretation of Biological Statistics of Fish Populations*. Bulletin of the Fisheries Research Board of Canada. 191: 382 pp.